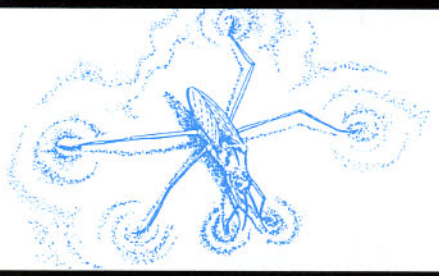
SAN FRANCISCO ESTUARY PROJECT

How We Use the Estuary's Water

The Estuary and its watershed provide waterways for shipping and recreation, as well as vital fresh water to farms, cities, industries and other users throughout California. Such uses, combined with increasing pollution and human development, have placed significant stresses on the Estuary's fish and wildlife. The need to balance competing uses and ensure adequate protection for the estuarine ecosystem has never been more urgent. The San Francisco Estuary Project is working with public interest groups, elected officials and government agencies to promote environmentally sound management of the Bay and Delta.



History

Use of the Estuary's resources began with Native Americans, who found food and construction materials in its waters and wetlands. With the Gold Rush, hordes of newcomers began to take fish and wildlife in large numbers. Hydraulic mining operations stripped away entire hillsides of gold-bearing gravel, causing enormous amounts of silt and sand to wash down the Sacramento River and into the Estuary. Most of the Estuary's wetlands were diked and converted to farming or urban uses.

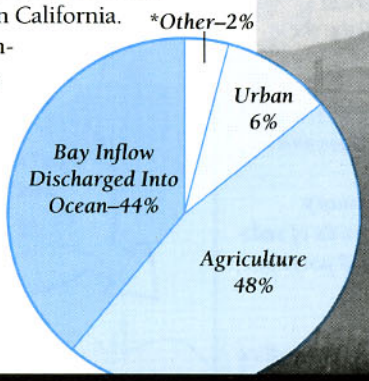
Over the turn of the century, increasing amounts of Central Valley land were converted from cattle ranches and dry-farmed grain to irrigated agriculture. At the same time, Bay cities began diverting water from the Tuolumne and Mokelumne Rivers for municipal use.

Between 1950 and 1970, major physical alterations were made to the Estuary and its watershed in the form of dams, canals, pumping stations and other freshwater development and flood control facilities. Construction of the Central Valley and State Water Projects provided enormous benefits—fueling economic growth in agriculture, providing municipal and industrial water supplies, and enhancing the quality of life in California.

In time, however, such intensive use of the Estuary's waters had major environmental impacts, including: the visible shrinking of the Bay's surface area, the elimination or alteration of 92% of the Estuary's tidal wetlands, the concentration of pollutants, the decline of fisheries, non-native species growth, and dramatic changes to the Estuary's flow regime.

Vital Fresh Water

Californians use 21.1 billion gallons of fresh water a day (25% of U.S. consumption). Two-thirds of the State's present demand for fresh water originates in the San Joaquin Valley and south of the Tehachapi Mountains. Two-thirds of the available supply, however, is carried by Northern California rivers and streams. The Estuary's Sacramento–San Joaquin Delta is the important link between supply and demand. In recent years, more than half of the Estuary's natural river flow has been diverted for human and natural uses. Beneficial uses—uses with legal protection against degradation in water quality—include domestic, municipal, agricultural and industrial supply, recreation and navigation, and fish and wildlife habitat. With demand for the Estuary's limited freshwater supply increasing on all sides, California is now struggling to provide for all beneficial uses while protecting the health of the estuarine ecosystem.



Uses of the S.F. Bay–Delta Freshwater Supply

*Other uses include conveyance losses, energy production, recreation, and riparian vegetation.

The Estuary

San Francisco Bay and the Delta combine to form the West Coast's largest estuary. The Estuary's watershed drains approximately 60,000 square miles, over 40 percent of the state. The Bay-Delta Estuary encompasses roughly 1600 square miles, contains about 5 million acre-feet of water at mean tide, and circulates 80-280 million cubic yards of sediment every year. More important, the Estuary is the location where the Sacramento and San Joaquin Rivers meet and flow into the Pacific Ocean. The mingling of fresh and salt water in this zone of tidal ebb and flow supports more biological diversity than is found in either salt water or fresh water alone.

Development Data

- *More than 7000 water right holders, with some 14,000 permits and licenses to annually remove water, affect the use of water within the Estuary and its watershed.*
- *The federal Central Valley Project operates 20 dams and reservoirs, eight power plants and about 500 miles of canals and aqueducts.*
- *The State Water Project operates 22 dams and reservoirs and hundreds of miles of canals and aqueducts.*
- *Of the approximately 16 million acre feet of water currently diverted within the Estuary's watershed, the Central Valley Project and the State Water Project together remove nearly 10 million acre-feet each year.*
- *Water diversions upstream of the Delta reduce inflows by more than nine million acre-feet of water.*
- *Diversions by Delta farmers and export pumps remove about seven million acre-feet of water.*
- *There are more than 400 reservoirs in the Estuary's watershed, which together are capable of storing 33 million acre-feet of water.*

Water Contacts

CALFED Bay-Delta Program, *1416 Ninth St., Room 1155, Sacramento, CA 95814 (916) 657-2666*

California State Dept. of Water Resources, *P.O. Box 942863, Sacramento, CA 95811 (916) 653-7247*

Central Valley Regional Water Quality Control Board, *3443 Routier Rd., Suite A, Sacramento, CA 95827-3098 (916) 255-3000*

S.F. Bay Regional Water Quality Control Board, *2101 Webster St., Suite 500, Oakland, CA 94612 (510) 286-1255*

State Water Contractors, *555 Capitol Mall, Suite 725, Sacramento, CA 95814 (916) 447-7357*

State Water Resources Control Board, *P.O. Box 100, Sacramento, CA 95812-0100 (916) 657-2390*

U.S. Bureau of Reclamation, *2800 Cottage Way, Sacramento, CA 95825-1898 (916) 979-2837*

U.S. Environmental Protection Agency, *75 Hawthorne St., San Francisco, CA 94105 (415) 744-2125*

Water Watchdogs

BayKeeper, *Fort Mason, Bldg. B, San Francisco, CA 94123 (415) 567-4401*

DeltaKeeper, *3536 Rainier Ave., Stockton, CA 95204 (209) 464-5090*

Environmental Defense Fund, *5655 College Avenue, Suite 304, Oakland, CA 94618 (510) 658-8008*

Save S.F. Bay Assn., *1736 Franklin St., 4th Floor, Oakland, CA 94612 (510) 452-9261*

Fish and Wildlife Habitat: *The Estuary supports a complex ecosystem and food chain. Clams, shrimp, worms and other organisms serve as essential food for fish and birds. Anadromous fish such as salmon, steelhead trout and striped bass also use the Estuary. Two-thirds of California salmon pass through the Estuary to spawning grounds upriver, sustaining rich commercial fisheries in the past and some commercial fishing today. In addition, half the birds on the Pacific Flyway and hundreds of resident bird species feed, rest and nest on Estuary shores and waters.*

Farming: *Water diverted from the Estuary watershed irrigates over 4.5 million acres of farmland. Some re-enters rivers and the Estuary as agricultural drainage.*

Drinking Water: *The Bay–Delta watershed provides drinking water for 20 million people—two thirds of the State. Central Valley cities, San Francisco and the East Bay remove water far upstream, while Delta communities, the counties of Contra Costa, Santa Clara, Napa and Solano, and Southern California, take municipal water from the Delta.*

Recreation: *Californians use the Estuary for fishing, hunting, boating, sailboarding, swimming and bird watching. The Estuary supports 290 shoreline parks, 200 duck clubs, 275 marinas, and about 286,000 recreational boaters.*

Shipping: *Estuary waterways support six major ports—serving over 4000 commercial vessels every year—as well as many military bases.*

Sewage Treatment: *Cities up and down the Estuary have long used its waters for disposal of sewage effluent, relying on outward flows from rivers to ocean, as well as the ebb and flow of tides, to disperse effluent. In 1992, the combined average volume of wastewater discharged by the more than 50 publicly owned sewage treatment works serving the Bay and Delta was 750 million gallons a day.*

Industry: *Many industries use the Estuary's water for cooling, cleaning and other processes. Others locate on the Estuary's shore to have direct access to ships and a convenient outlet for wastewater. In 1992, the combined average volume of wastewater discharged into the Estuary from chemical, metal finishing, paper and other industries was approximately 80 million gallons a day (not including gas and electrical utilities), over one-fourth of which came from the North Bay's six petroleum refineries.*

Hydropower: *Flows through the Estuary's watershed sustain electric powerhouses at over 700 locations.*

Dredged Material Disposal Site: *Estuary waters receive over seven million cubic yards of sediments dredged from shipping channels and ports at these sites each year.*

Salt Ponds: *Estuary waters yield more than 1 million tons of salt for industrial and human uses every year.*

Water Export Pumps

Water Use and Development

Environmental Concerns About Flows

Many of the environmental impacts resulting from use of the Estuary's waters cannot be eliminated. Much can be done, however, to mitigate these uses and improve environmental conditions. Efforts to curb pollution, restore wetlands, and conserve and reclaim water have all begun in earnest. Meanwhile, the degree to which freshwater diversion has exacerbated environmental problems is the subject of statewide controversy. The debate centers on the following issues.

Laws and Planning

Clearly, there is no easy way to decide how to use California's water. The concerns of diverse interests must be addressed; consensus must be built on statewide water planning and allocation, and resulting management actions must be effectively implemented and funded. Three major events have influenced California water policy in the past decade.

In 1986 the State Court of Appeals directed the State Water Resources Control Board to take a global view of all demands on the state's water and to provide reasonable protection for all beneficial uses. The court interpreted California statutes as giving the Board broad power to establish water quality standards. The court also found that in order to achieve those standards, existing statutes authorize the Board to modify the water rights permits of all upstream diverters.

In 1992, Congress passed the Central Valley Project Improvement Act (CVPIA). The CVPIA dedicates approximately 15 percent of the federal water project's annual yield to restoration of fisheries and wetlands, including the development of a program to double the natural production of anadromous fish by 2002. Litigation has slowed implementation of this law.

In December, 1994, the federal and state governments, urban water users and agricultural and environmental representatives signed an agreement on new Bay-Delta water standards. The agreement covers a wide range of issues, including salinity standards, flow requirements and species protection. This unique agreement represents the first time that water interests were willing to compromise to reach what most believe is a fair and balanced accord. After holding public hearings and soliciting comments on the agreement, the State Water Resources Control Board (SWRCB) adopted the 1995 Bay-Delta Water Quality Control Plan, which contains many of the provisions in the December agreement. Under its water rights authority, the SWRCB will determine which water users in the Bay-Delta watershed should help meet water quality and flows requirements. The new standards are viewed as shifting management from a constraint on taking endangered species at the pumps to a constraint on operating the water projects in real-time. It is unclear how these new standards will affect the CVPIA.

Flow Volume

Before water development, annual runoff into the Estuary probably ranged from 19 to 29 million acre-feet. Variations in these flows were determined entirely by rain and snowfall. Water storage and diversion projects now largely control these flows and have reduced the total annual outflow of fresh water to the Estuary by as much as 70 percent in recent drought years. Over the past half century, the average volume diverted has been close to 50 percent. Debate continues, however, over whether flow volume has really changed that much in the long-term.

Timing of Water Diversions

The timing of flows exerts a far greater influence on estuarine biological productivity than any change in the total annual volume of flows. Water stored during winter and spring months for release later in the year greatly reduces flows during April, May and June, and increases them during the late summer and fall. Due to water storage and diversions, spring Delta outflow to the Bay is reduced by two-thirds in an average rainfall year.

An array of biological effects is associated with the reduction of spring and early summer flows and with human-engineered changes in flow patterns. First, flows are now spread more evenly throughout the year, and some scientists believe vigorous spring pulses have been reduced. These pulses may help flush contaminants out of the estuarine ecosystem and also foster high productivity of phytoplankton in the South Bay. Second, some fish species need high spring flows for migration (see opposite). Third, flow volume and timing influence the productivity of the "null" zone where outgoing fresh water meets incoming salt water. Microscopic plants concentrate in and downstream of this zone, which in turn provide food for invertebrates, shrimp and juvenile fish. When flows are low, the location of this zone shifts from the broad shallows adjacent to Suisun Bay upstream into narrower, deeper channels less conducive to biological productivity. The degree to which this zone contributes to the Estuary's overall biological productivity continues to be studied.

Diminishing Fisheries

Over the years, flood control, water development, increased pollution, habitat loss, overfishing, drought and other factors have decimated the Estuary's once rich fisheries. The impacts of freshwater diversion are wide-reaching. First, at certain times of year, the CVP and SWP export pumps suck river water flowing to the ocean back inland. These *reverse flows* disorient anadromous fish. Second, fish that make it through the Delta find vastly reduced habitat upstream, primarily because dams block the way and trap gravel needed for spawning beds. Of an original 6000 miles of habitat available to salmon in the Central Valley, only about 300 miles remain. Third, despite fish screens, millions of fish eggs, larvae and young moving downstream are entrained in water project pumps. Fourth, fish must contend with 1800 unscreened diversions to farms along Delta waterways. Fifth, fish migrating both upstream and downstream suffer from warm waters released from water storage and flood control projects.

Salinity Changes

Before the CVP and the SWP began operation, freshwater flows to the Delta were very low during summer months, and in especially dry months, salt water intruded far into the Delta. After the projects were built, they released stored water to contractors and additional water to prevent salt water intrusion. Salt water intrusion threatens drinking water supplies. Even small amounts can adversely affect the quality of drinking water, and bromides in salt water can combine with chlorine used in water disinfection to create harmful by-products. New flow standards issued by the federal and state governments address salt water intrusion issue and related concerns.

Pollution

Despite daily tides moving in and out, the Estuary is still vulnerable to pollution. Great progress has been made in reducing municipal and industrial pollution. However, urban and agricultural runoff remain a vast problem. High volumes of freshwater flows reduce the residence time of water in the Estuary. Under high Delta outflow, water residence times are a couple of weeks; under low outflow, several months. Water residence times may affect exposure of fish to pollutants.

Increasing Urban Demand

The State's population is expected to reach more than 40 million by 2005. To meet increasing water demand while providing flows for fish and wildlife, all options must be considered, from reallocating and conserving existing water supplies to building new facilities. Resulting social and economic impacts from reallocation must be effectively addressed. A start was made in 1991 when the State Water Bank, created by Governor Wilson, bought 800,000 acre-feet from farmers to resell to drought-stricken urban and agricultural water agencies. Approximately 655,000 acre-feet were resold.

Estuary Project Goals

The San Francisco Estuary Project's primary goal is to restore and maintain water quality and natural resources while promoting effective management of the Bay and Delta. The Comprehensive Conservation and Management Plan (CCMP), the Estuary Project's blueprint to restore the Bay and Delta, was adopted and approved by the state and federal governments in 1993. An Implementation Committee meets quarterly to oversee implementation of the 144 CCMP actions. The Implementation Committee has representatives from the business, environmental and agricultural sectors, state and federal agencies, and locally elected officials. Three geographic subcommittees representing the North Bay, South Bay and Delta assist the Implementation Committee with local CCMP implementation activities. If you would like to learn more about the San Francisco Estuary Project or the CCMP, please call (510) 286-0460.

Published by SFEP, April 1996 Printed on recycled paper Design: N. Lisowski Cover Photo: Bob Walker Waterstrider: Ane Rovetta Oysters: Ricardo Perez